Reading. 1. The function of reading in imaging, its relation to observation; 2. Learning to read, technical treatment; 3. The tests of good reading matter, examples to be selected from the library; 4. Interpretations of nature study and literature.

References: *Nature Study and Related Subjects*, Jackman, Part I. *The Correlation of Science and History, Educational Review*, May, 1895.

Study. 1. Modes of study, the purpose of study; 2. Essential conditions for study, the function of the teacher; 3. The use and limitation of books in study; 4. The personal element in study.

The Recitation. 1. The purpose of the recitation; necessary preparation; 2. The mutual relations of the class and the individual in recitation; 3. The function of the teacher in the recitation; 4. General plan of the recitation; common errors.

The Art of Criticism. 1. The basis upon which a school should be judged; 2. The basis upon which a teacher should be judged; 3. The proper modes of testing pupils; 4. Results that may be taken as a trustworthy basis for judgment.

References: *The School Grade a Fiction; Educational Review*, May, 1898.

Moral Aspects of Nature Study. 1. What should be expected, from the standpoint of morality, of pupils at the age when they enter the high school? 2. Incidental relations of Nature Study to morality and general culture. 3. Cultivation of the Will. 4. Development of Good Will.

References: *Nature Study and Related Subjects*, Jackman, Part I. *Nature Study for the Common Schools*, Jackman. *Ethics and Evolution*, John Dewey. *The Monist*, April, 1898. *Evolution and Ethics*, Huxley, *Popular Science Monthly*, November and December, 1883.

The Round Table Discussions will deal with the methods observed in the practice school, and in the laboratory work of the afternoon. In these discussions the practical aspects of Nature Study will be considered under some of the following heads:

I. Field Work in Nature Study. The landscape as a moving picture. The landscape as an organism. Chapters in its history. Human development related to the landscape.

II. Color and Form in the Landscape.— Significance of color and form. Illustrated by work done by the children in the practice school.

III. The Landscape as a Scene of Activity. Activities of plants and animals; from the isolated seed to the all-related plant. Establishment of its relations with heat, moisture, light, growth of root, stem, and leaf. The plant's time and space relations; flower and seed. External and internal adaptations of the plants. Competition. Mutual support. Activities of animals. Conditions favoring colonization; soil, water, shores, rocks, lowlands, etc. Examples: A tree as a center of colonization. The aspects of water that invite colonization. The atmosphere. Migration and extinction of colonies. Relations between plants and animals. External and internal adaptations of the animal forms.

The Courses in Physics and Chemistry

Charles W. Carmen

The courses in physics and chemistry are intended to meet the needs of those teachers who desire to introduce physical science into the common schools. It will be the aim, during the session of the Summer School, to aid the teacher in getting the information, explanations, and apparatus that he most desires, and that is best adapted to his use.

Have you met difficulties during the past year's experience as a teacher? What are they? Have you wished to perform simple experiments, but were unable to provide the apparatus? Have you thought out any definite line of work? Do you wish such a line of work planned for you? Propounding and answering questions along these lines will be the nature of the work rather than a formal course in physical science. The phenomena of nature are so numerous that it matters little what branch we take up.

Considerable attention will be given to meteorology because it is a subject of unusual interest for nature study in the grades, the high schools, and for the advanced scientist. Many of the observations are easily made, and the general laws governing the predictions of weather bureaus are readily discovered. Another fruitful source of study is that which traces every change that is observed in the inorganic, organic, and organized world to solar energy. The subject, when properly presented, has never failed to arouse interest, even in the usually dormant mind.

While it will be the aim to keep the class-room and laboratory work in as close touch as possible with the field work in general, it is desirable to make a preparation in the class-room and laboratory in order that the best results may be accomplished in the field, hence the arrangement of the work as given below.

The laboratory work following that done in the field will be the tabulating of results and arranging them in a form for work in mathematics. What have we learned from our laboratory and field work? The results are to be condensed and recorded in the form most useful for future reference.

The subject of physics is largely the subject of measurements. To make measurements of any considerable value preliminary training is necessary. Therefore field work will be preceded by the use of such apparatus as is to be used in the field. It is planned that the first measurements in the field will be of length contemplating area and volume. These are to be followed by mass, temperature, quantity of heat, and magnetism.

The field work will be an application of the laboratory apparatus to field use. It is proposed to make measurements on the plat studied for the determination of its area, topography, angles of variation of different sections, variations of ground and water levels, heights, and circumferences of trees and leaf surfaces.

The study of chemistry is largely a study of the results of construction and destruction of chemical compounds. How are we to destroy and construct, in the laboratory, mineral and soil formations? It is contemplated that minerals and soils will be the first branch of field study.

Guided by the laboratory work, an intelligent collection in the field may be expected on the part of the student.

The following outline will give the student, in a condensed form, the general plan on which it is hoped to conduct the work:

The Course in Physics

I. Leading Principles.

1. A brief statement of the subject-matter.
2. Discussions of the plan of work proposed.
3. Laboratory work as a preparation for field word.
4. Field work.
5. Laboratory work upon data and material gathered in the field.
6. Discussion of the results obtained from field and laboratory.

NOTE.—A prominent part of the course is planned to be the outlining of methods for, and the actual construction of, inexpensive apparatus for grammar grade exercises (experiments).

1. (a) Standard units, reference to same, use of. (b) Restricted use of the term physics; relation of physics to biology, geology, chemistry, astronomy, mathematics; method and aim, theory, experiment, qualitative work; quantitative work; measurements. (c) General subdivision of the subject into the physics of matter, the physics of ether. Molar and molecular physics, including mechanics, sound, heat. Ether physics, including "radiant heat," light, electricity, and magnetism.

II. Introduction to Meteorology. (a) The province of meteorology. (b) Brief sketch of the growth of the study. (c) The modern contrasted with the early study of the subject. (d) Meteorological phenomena. (e) Meteorological intruments. (f) Construction and use of meteorological instruments. (g) Meteorological observations. (h) Barometer, barograph, thermometers, thermograph, anemom-

eter, anemograph, hygrometer, rain gauge. (i) History and growth of the signal service. (j) How to make weather maps. (k) How to read weather maps. (l) How to forecast the weather. (m) The study applied to animal and plant life. (n) The value of the study to commerce.

Introduction to Mechanics. (a) Simple machines. (b) Function of machines. (c) Animals as machines. (d) Plants as machines. (e) Observations on and study of such machines as levers, cord and pulley, windmills, water-wheels, cranes, elevators, steam engines. (f) Construction and use of simple mechanisms. (g) Aid to the industries of life.

Introduction to Sound. (a) Mechanisms for producing sound. (b) Hearing. (c) The uses of hearing. (d) Hearing "without ears." (e) Sources of sound. (f) Different kinds of vibrations. (g) Sound that is "noise" only. (h) Musical sounds. (i) Different kinds of sounds heard in the field.

Introduction to Heat (Molecular). (a) Nature of heat. (b) How related to matter. (c) Sources of heat. (d) Relation of quantity of heat to temperature. (e) Measurements of temperature. (f) Measurement of quantity of heat. (g) Molecular motion changed to mass motion. (h) Machines for producing heat. (i) Machines for expelling heat (ice machines). (j) Heat the primary form of energy in animal and plant growths. (k) The factor of heat in ventilation. (l) The factor of heat in the life of a universe.

Introduction to "Radiant" Heat and Light. (a) Ether dynamics. (b) The ether. (c) The radiometer. (d) Sunshine. (e) Measurement of sunshine. (f) Mechanical analysis of sunshine. (g) Heat, light, color. (h) Concentration of sunshine. (i) "Artificial" sunshine. (j) Sunshine and animal life. (k) Sunshine and plant life. (l) Indirect influence of sunshine on life in general.

Introduction to Magnetism. (a) Observations on magnets. (b) Magnetic substances. (c) Magnetometers and compasses. (d) Artificial magnetic regions. (e) Explorations in the field. (f) Magnetic observations in general. (g) Effect of magnetism on life.

Physics that May be Observed During the Daily Pursuits of Life.

III. Books of Reference. Elementary Physical Science: (a) Jackman, W. S.—Nature Study for Grammar Grades. (b) Jackman, W. S.—Field Work and Nature Study. (c) Jackman, W. S.—Nature Study Record. (d) Harrington, C. L.—Physics for Grammar Schools. (e) Woodhull, J. F.—Manual of Home-made Apparatus. (f) Woodhull, J. F. —First Lessons in Light. (g) Mayer, A. M. —Sound. (h) Mayer & Barnard—Light. (i) Barnard, C.—First Steps in Electricity. (j) Hall, E. H.—Elementary Lessons in Physics. (k) Bower, J. W.—Simple Experiments for Scientific Teaching. (l) Boys, C. V.—Soap Bubbles. (m) Perry, J.—Spinning Tops. (n)) Bert, P.—Primer of Scientific Knowledge. (o Hopkins, G. N.—Experimental Science.

For Special Reference. (a) Carman, C. W. —Outline of Course in Physics. (b) Chute, H. N. — Physical Laboratory Manual. (c) Chute, H. N.—Practical Physics. (d) Carhart & Chute—The Elements of Physics. (e) Crew, H.—Elements of Physics. (f) Davis, W. M.—Elementary Meteorology. (g) Daniell, A.—Principles of Physics. (h) Everett, J. D.—C. G. S. Units. (i) Hastings & Beach—General Physics. (j) Weather Bureau, U. S. —Publications.

The Course in Chemistry

I. Leading Principles.

1. A brief statement of the subject matter. (a) The general method of treatment in text-books; the method of using text-books for reference; laboratory and field chemistry versus text-book chemistry. (b) Restricted use of the term chemistry; relation of the subject to biology, geology, physics, astronomy, mathematics, theory, experiment, qualitative and quantitative work. (c) General subdivision of the subject into inorganic and organic chemistry. The study of homogeneous compounds—metallic, non-metallic; world-building before the advent of life. The study of organic and organized matter; world-building after the advent of life.

2. Discussions of the plan of work proposed.

3. Laboratory work as a preparation for field work.

4. Field work.

5. Laboratory work upon data and material gathered in the field.

6. Discussion of the results obtained from field and laboratory.

II. Subject Matter.

Introduction to the Study of Mineralogical Chemistry. 1. Chemical characteristics: (a)

Taste; astringent, sweetish astringent, saline, alkaline, cooling, bitter, sour. (b) Odor: alliaceous, sulphurous, fetid, argillaceous. (c) Solubility; water, acids, alkalies. (d) Fusibility; scales of. (e) Volatility; volatile, partially volatile, non-volatile.

2. Laboratory processes.
3. Field study and collections.
4. Laboratory study of collections.
5. Tabulating and condensing results for future reference.

Introduction to the Study of Soil Formations. 1. Mechanical separations: (a) Mineral. (b) Organic.

2. Physical and chemical separations: (a) Fluid, solid. (b) Separation of fluids into chemical constituents. (c) Separation of solids into chemical constituents.

3. A study of the properties of the chemical constituents.

Introduction to the Study of Animal and Vegetable Formations. 1. Physical and chemical separations: (a) Fluid, solid. (b) Separation of fluid parts into chemical constituents. (c) Separation of solid parts into chemical constituents.

2. A study of the properties of the chemical constituents.

III. Books of Reference. *Elementary Chemical Science*, Jackman, W. S. *Nature Study for Grammar Schools*, Jackman, W. S. *Field Work and Nature Study*, Jackman, W. S. *Nature Study Record*, Bower, J. W. *Simple Experiments for Science Teaching*, Roscoe—*Chemistry* (Science Primer Series). Collins, J. H. *A First Book on Mineralogy*, Faraday, M. *The Chemical History of a Candle*, Appleton, J. H. *Chemistry*, Memsen, I. *An Introduction to Study of Chemistry*, Remsen, I. *A Laboratory Manual*, Remsen, I. *Organic Chemistry*, Orndorff, W. R. *Laboratory Manual, Organic Chemistry*, Coit, J. M. *Chemical Arithmetic*, Cross, G. M. *Chemical Technics*, Williams, R. P. *Elements of Chemistry*, Williams, R. P. *Laboratory Manual*, Shepard, J. H. *Elements of Chemistry*, Wiley, H. W. *Principle and Practice of Agricultural Chemistry*, Church, A. H. *The Laboratory Guide.*

Study of Animal Life

Ira B. Meyers

The work in zoölogy will be confined largely to a study of œcological relations as determined by Chicago environs, and illustrated by the field about Winnetka.

The various features of a landscape—facing, altitude, soil, moisture, temperature, and vegetation—are factors in the problem of adaptation to the animal life of the area. It is the aim of the field work to observe conditions under which animal life exists in any given area, and to note the influence of constant and varying factors upon its habits, characteristics, and life history.

The museum and laboratory work aims to aid the œcological studies of the field by (a) closer and more detailed observation of minute forms and structures; (b) study of internal structures; (c) continued observation of living forms through aquarium and cage; (d) comparing homologous structures and functions of allied forms.

Physiographic features: Lake, sand, and pebble shore; shore bluff; prairie; swamp.

Botanical features. (See Botany Outline.)

Zoölogical groups: Insects; crustaceans; batrachians; reptiles; birds; mammals.

General observations: Forms found in each special physiographic feature: (a) Dominant forms. (b) Occasional forms.

Range: Forms unrestricted in extent of range. Forms restricted to a particular part of the area. Forms attracted by some physiographic feature of the area—permanent residents. Forms attracted by seasonal food—temporary residents.

Movement: Demands for movement; range; factors influencing movement. Modifications of organs of locomotion: (a) As affected by the different media. (b) As affected by some peculiar aspect of the same medium. (c) As modified by peculiarity of habit.